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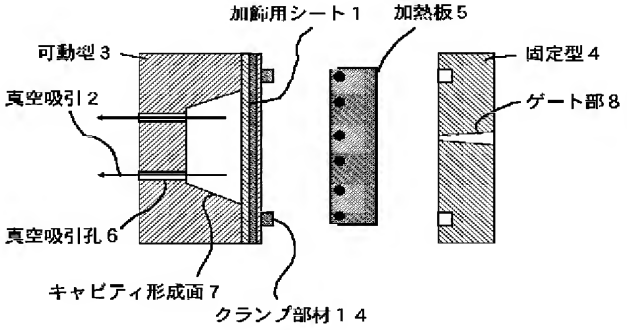
(54)【発明の名称】　真空成形加工に適した加飾用シート、これを用いた成形シートの製造方法、成形同時加飾成形品の製造方法および成形同時加飾成形品

(57)【要約】

【課題】　真空成形加工に適した加飾用シートとこれを用いた成形シートの製造方法、成形同時加飾成形品の製造方法および成形同時加飾成形品を提供する。

【解決手段】　真空成形加工において、真空成形加工する直前の加飾シートの表面温度をＴ（℃）、加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率が、２５℃で実施したときのヤング率の５０％になったときの加飾用シートの表面温度をＴｈ（℃）、真空成形加工する加飾用シートの厚みをｔ（ｍｍ）、面積伸び比をＸ、Ｔｈ（℃）の環境温度下で、加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率をｋ（Ｐａ）としたとき、$25<Th\leqq T\leqq(100+Th)$、および$20\leqq(T-Th)^2/(X\times k\times t^3)\leqq 7.1\times 10^{-3}$の条件を満たす。



【特許請求の範囲】
【請求項１】 少なくとも基材フィルムと加飾層とから構成され、後に所望の形状に真空成形加工して成形同時

$$２５＜Ｔｈ≦Ｔ≦（１００＋Ｔｈ）\quad …（１）$$

$$０≦（Ｔ－Ｔｈ）^{２}／（Ｘ×ｋ×ｔ^{３}）≦７．１×１０^{－３}\quad …（２）$$

Ｔ（℃）　：真空成形加工する直前の加飾シートの表面温度
Ｔｈ（℃）：加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率が、２５℃で実施したときのヤング率の５０％になったときの加飾用シートの表面温度
ｔ（ｍｍ）：真空成形加工する加飾用シートの厚み
Ｘ： 面積伸び比
ｋ（Ｐａ）：Ｔｈ（℃）の環境温度下で加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率
【請求項２】 請求項１の加飾用シートを上記（１）及び（２）の条件で所望の形状に真空成形加工して成形シートを得ることを特徴とする成形シートの製造方法。
【請求項３】 少なくとも基材フィルムと加飾層とから構成される加飾用シートを射出成形用の金型内に入れ、型閉め後、成形樹脂をキャビティに射出し、樹脂成形品の表面に加飾用シートを一体化接着させて成形同時加飾を行う成形同時加飾成形品の製造方法において、成形樹脂をキャビティに射出する前に、射出成形用の金型内又は金型外にて請求項１の加飾用シートを上記（１）及び（２）の条件で所望の形状に真空成形加工しておくことを特徴とする成形同時加飾成形品の製造方法。
【請求項４】 請求項１の加飾用シートが、所望の形状に真空成形加工されて樹脂成形品表面に一体化接着されていることを特徴とする成形同時加飾成形品。
【発明の詳細な説明】
【０００１】
【発明の属する技術の分野】本発明は、立体形状成形品の表面を加飾するために真空成形加工して用いられる加飾用シートと、これを用いた成形シートの製造方法、成形同時加飾成形品の製造方法および成形同時加飾成形品に関する。
【０００２】
【従来の技術】従来より、コンソールボックス、センタークラスター、スイッチベースなどの自動車内装部品や携帯電話筐体などの通信機器部品を加飾する方法としては、加飾用シートを用いた成形同時加飾法がある。この方法は、少なくとも基材フィルムと加飾層とから構成される加飾用シート１を射出成形用の金型内に入れて、型閉め後、成形樹脂９をキャビティ１０に射出し、成形樹脂９を固化した樹脂成形品１１の表面に加飾用シート１を一体化接着させて成形同時加飾成形品１５を得るものである（図３～５参照）。
【０００３】上記成形同時加飾法においては、通常、成形樹脂９をキャビティ１０に射出する前に、射出成形用の金型内又は金型外にて加飾用シート１を可動型３のキャビティ形成面７に沿うようにあらかじめ立体加工を施し成形シート２１としておく。
【０００４】現在、この立体成形加工の方法として広く一般に利用されている方法には、真空成形加工がある。たとえば、加飾用シート１を射出成形用の可動型３のキャビティ形成面７前面にセットした後に、可動型３と固定型４との間に挿入した加熱板５等で加飾用シート１を加熱して軟化させ、軟化状態の加飾用シート１と可動型３の加飾用シート１に対向する面との間の空間を密閉して真空吸引孔６から排気及び空間内の気圧を下げる、所謂真空吸引２を行なうことにより、加飾用シート１を引き伸ばして可動型３のキャビティ形成面７に沿うように立体形状に加工し、成形シート２１を得る（図１および図２参照）。
【０００５】また、真空成形加工の別の例としては、加飾用シート１を射出成形用の可動型３にセットする前に、射出成形用の可動型３と固定型４とは別の立体加工成形用型１２を用い、立体加工成形用型１２の成形面前面に加飾用シート１を間に介して配置した加熱板等で加飾用シートを加熱して軟化させ、軟化状態の加飾用シート１と立体加工成形用型１２の成形面との間の空間を密閉して真空吸引２することにより、加飾用シート１を引き伸ばして立体加工成形用型１２の成形面に沿うように立体形状に加工して成形シート２１を得た（図６参照）のち、射出成形用の可動型３のキャビティ形成面７に、立体加工された加飾用シート１（成形シート２１）をはめ込む（図７参照）。
【０００６】
【発明が解決しようとする課題】しかし、前記した手段により加飾用シートを真空成形加工した場合、その条件設定が不適当であると、加飾用シートの意匠が極端に歪んだり、加飾用シートが破れたり、また真空成形加工によっても加飾用シートが所望の形状に充分に立体加工されなかったりといった問題が生じやすい。
【０００７】したがって、本発明の目的は、上記の問題点を解決することにあり、真空成形加工に適した加飾用シートとこれを用いた成形シートの製造方法、成形同時加飾成形品の製造方法および成形同時加飾成形品を提供することにある。
【０００８】
【課題を解決するための手段】上記目的を達成するために、本発明は、少なくとも基材フィルムと加飾層とから構成され、後に所望の形状に真空成形加工して成形同時

加飾に用いられる加飾用シートであって、真空成形加工する直前の加飾シートの表面温度をＴ（℃）、加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率が、２５℃で実施したときのヤング率の５０％になったときの加飾用シートの表面温度をＴｈ（℃）、真空成形加工する加飾用シートの厚みをｔ（ｍｍ）、面積伸び比をＸ、Ｔｈ（℃）の環境温度下で加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率をｋ（Ｐａ）としたとき、２５＜Ｔｈ≦Ｔ≦（１００＋Ｔｈ）、および０≦（Ｔ－Ｔｈ）^{2}／（Ｘ×ｋ×ｔ^{3}）≦７．１×１０$^{-3}$の条件を満たすように構成した。

【０００９】また、本発明の成形シートの製造方法は、真空成形加工に適した加飾用シートを上記各式の条件で所望の形状に真空成形加工して成形シートを得るように構成した。

【００１０】また、少なくとも基材フィルムと加飾層とから構成される加飾用シートを射出成形用の金型内に入れ、型閉め後、成形樹脂をキャビティに射出し、樹脂成形品の表面に加飾用シートを一体化接着させて成形同時加飾を行う成形同時加飾成形品の製造方法において、本発明は、成形樹脂をキャビティに射出する前に、射出成形用の金型内又は金型外にて前記真空成形加工に適した加飾用シートを上記各式の条件で所望の形状に真空成形加工しておくように構成した。

【００１１】また、本発明の成形同時加飾成形品は、前記真空成形加工に適した加飾用シートが所望の形状に真空成形加工されて樹脂成形品表面に一体化接着されているように構成した。

【００１２】

【発明の実施の形態】以下、図面を参照しながら本発明をさらに詳しく説明する。図１、図２および図６は加飾用シートの真空成形の工程の一つを示す断面図、図３、図４および図７は成形同時加飾成形品の製造方法の工程の一つを示す断面図、図５は成形同時加飾成形品の例を示す断面図、図８は引張試験において使用する引張試験機を示す斜視図、図９は引張試験において引張試験機の試験片を固定する部分を示す断面図、図１０は加飾用シートの伸び特性を示すグラフ、図１１は真空成形によって加飾用シートに歪みが発生した場合を示す図、図１２は真空成形によっても加飾用シートに歪みが発生しない場合を示す図、図１３は加飾用シートの面積伸び比を説明する図である。図中、１は加飾用シート、２は真空吸引、３は可動型、４は固定型、５は加熱板、６は真空吸引孔、７はキャビティ形成面、８はゲート部、９は成形樹脂、１０はキャビティ、１１は樹脂成形品、１２は立体加工成形用型、１４はクランプ部材、１５は成形同時加飾成形品、１６は試験片、１７はネジ、１８はチャック、１９はチャック、２０は可動部材、２１は成形シートをそれぞれ示す。

【００１３】真空成形加工では、加飾用シート１を射出成形用の可動型３あるいは立体加工成形用型１２の前面に配置した後、当該金型表面に加飾用シート１をクランプ部材１４等によって押さえ付けることによって加飾用シート１の真空成形加工する部分の周囲の全部または一部を固定しているため、その状態で真空吸引２されると加飾用シート１に荷重（張力）がかかることとなる。この荷重の増加に対し、弾性の限界点（弾性限度）に至るまでは比例して伸びが発生する比例部分があり（フックの法則）、この限界点を比例限度という。そして加飾用シート１がフックの法則に従うとき、比例限度内での垂直方向の荷重と伸びの比例定数をヤング率というが、それは図１０に示したように加飾用シート１の表面温度に対して依存性がある。ただし、加飾用シート１の表面温度と加飾用シート１の伸びとの間に比例関係があるわけではなく、常温からある温度まではほとんど同じ伸び方を示し（図１０中T_1，T_2）、その温度を超えると急速に伸びやすくなり、ヤング率が低下する傾向がある（図１０中T_3，T_4）。

【００１４】この急速に伸び始めたときの温度を超えて加飾用シート１の表面温度を高くすればするほど、真空吸引によって局所的な伸びのみでも所望の形状に成形することが十分可能となるため、加飾用シート１の意匠について、パターンが変形したり（図１１参照）、色の濃度が不均一になったりする等の極端な歪みが起こりやすくなる。したがって、加飾用シート１の表面温度を真空吸引によって歪みが生じにくい（図１２参照）温度に低く抑えるように加熱板５等にて加熱する必要がある。

【００１５】上記の急速に伸び始めたときの温度を超えて加飾用シート１の表面温度を高くして真空吸引した場合、その加飾用シート１の伸びは、ほとんど同じ伸び方を示す温度における加飾用シート１の伸びのおおよそ２倍以上である。そこで、まず本発明者らは、加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率が、常温、すなわち２５℃で実施したときのヤング率の５０％になる加飾用シートの表面温度Ｔｈ（℃）を基準として、加飾用シート１の表面温度を設定すればよいと考えた。

【００１６】そして、真空成形加工において意匠に歪みが生じにくくするには加工開始直前の加飾シートの表面温度Ｔ（℃）をどの程度に設定すればよいかを試験により確認した結果、表１～表３のようになり、１００＋Ｔｈ（℃）を超えて高く設定すると、つまりＴ≦（１００＋Ｔｈ）という条件を満たさないと、真空成形加工された加飾用シート１のほとんどで局部的な伸びによる不良が発生することがわかった。なお、真空成形加工する直前の加飾シートの表面温度Ｔ（℃）の測定は、金型の前面に配置した加飾用シート１の近くにサーモグラフィ装置を設置して測定する。また、表１～３の評価において、◎，○，△，×，は、それぞれ下記の状態を意味

し、これらの評価は各条件の下に１０回づつ実施した場合の結果による。
◎：意匠の歪みがなく、所望の形状に成形加工出来ている。
○：意匠の歪み又は成形加工不足が若干存在するが、いずれも成形同時加飾には全然問題がないレベルである。
△：意匠の歪み又は成形加工不足のために成形同時加飾で一部不良が発生している。
×：意匠の歪み又は成形加工不足のために成形同時加飾でほとんど不良が発生している。
【００１７】また、真空成形加工を開始する直前の加飾シートの表面温度Ｔ（℃）は、真空成形加工によって加飾用シート１に歪みが生じないようにただ低くすればよいというわけではなく、型形状に沿って寸法精度よく真空成形加工するには、加飾シート１が完全に軟化することが必要である。真空成形加工する直前の加飾シートの表面温度Ｔ（℃）がＴｈ（℃）未満であると、金型形状に沿って寸法精度よく真空成形加工できない。なお、表面温度がＴｈ（℃）の加飾用シートのヤング率は表面温度が２５℃の加飾用シートのヤング率の５０％であるから、２５℃の加飾用シートのヤング率より小さく、図１０に示したようにヤング率の低下は加飾用シートの温度上昇に因るから、２５＜Ｔｈである。
【００１８】以上のことから、使用する加飾用シート１の選択とその真空成形加工する直前の温度設定においては、少なくとも２５＜Ｔｈ≦Ｔ≦（１００＋Ｔｈ）　…（１）という条件を満たす必要がある。
【００１９】しかし、使用する加飾用シート１の選択とその真空成形加工する直前の温度設定とを上記式（１）が成り立つように行なっても、優れた真空成形加工の施された加飾用シート１を得られない場合がある。
【００２０】たとえば、真空成形加工時に加飾用シート１の剛性に対して加飾用シート１表面への熱負荷が相対的に大きすぎて成形しやすくなり過ぎると、加飾用シート１が強引に伸ばされて加飾用シート１の意匠に極端な歪みが生じ、場合によっては加飾用シート１が焼け焦げるという問題が生じることがあった。逆に、真空成形加工時に加飾用シート１の剛性に対して加飾用シート１表面への熱負荷が相対的に小さすぎて成形しにくくなり過ぎると、加飾用シート１が所望の形状に充分に立体加工されないという問題が生じることがあった。加飾用シート１の剛性に応じて加飾用シート１表面への熱負荷を設定しなければならないのである。
【００２１】また、成形同時加飾成形品の絞り形状に応じて、すなわち面積伸び比Ｘに応じて加飾用シート１表面への熱負荷を設定しなければならない。ここで、面積伸び比Ｘとは、真空吸引する前のシートの単位面積に対して真空成形後のシートの表面積がいくらになるかという比である（図１３参照）。
【００２２】つまり、真空成形に関する条件においては、上記式（１）以外に、成形同時加飾成形品の絞り形状や加飾用シート１の剛性を考慮し、（加飾用シート１表面への熱負荷）÷（面積伸び比×剛性）の数値がある一定の適正範囲内でなければならない。なお、この剛性は、本発明者らが試験した結果、加飾用シート１のヤング率ｋ（Ｐａ）と加飾用シート１の厚みｔ（ｍｍ）の３乗との積に比例する。ここで、ヤング率ｋ（Ｐａ）として本当は真空成形加工時のシート表面温度でのヤング率を採用すべきであるが、値が小さくなりすぎて誤差が生じるため、Ｔｈ（℃）でのヤング率を採用した。また、成形のしやすさは真空吸引を開始して完全に立体加工し終えるまでの時間を測定すれば数値化でき、横軸にＴ－Ｔｈ、縦軸に成形時間をとってみると（Ｔ－Ｔｈ）^{2}に比例して真空成形しやすくなることがわかったので、この（Ｔ－Ｔｈ）^{2}の大小を加飾用シート１表面への熱負荷の大小として捉えることとした。
【００２３】そこで、さまざまな条件によって試験した結果、表1～３の結果が得られ、これにより適正範囲は下記式（２）に示す範囲であることがわかった。

$$0 \leqq (T-Th)^{2} / (X \times k \times t^{3}) \leqq 7.1 \times 10^{-3} \quad \cdots (2)$$

【００２４】なお、本発明の加飾用シート１でのヤング率は、各環境温度下において、幅１０ｍｍの加飾用シート１の試験片１６を一対のチャック１８，１９を用いてチャック１８，１９間距離５０ｍｍで固定し、試験片１６の一端を５００ｍｍ／分の一定速度で荷重をかけて引張試験を実施したときの初期引張弾性率で定義する。また、環境温度とは、試験片１６が試験片１６周囲の雰囲気と同じ温度まで加熱された状態での温度である。
【００２５】試験片１６のサイズを大きくしないのは、試験片１６を引張する前に上記環境温度下にて試験片が軟化して皺だらけになるのを避けるためである。また、試験片１６のサイズをあまりに小さくすると測定誤差が大きくなるためである。したがって、測定誤差が問題にならない程度にできるだけ小さくした結果、上記のサイズとなった。なお、図８および図９において、上側のチャック１８は、試験片１６の上端を挟んだ状態でネジ１７により固定される。また、下側のチャック１９は、試験片１６の下端を挟んだ状態でネジ１７により固定される。図８および図９に示すように、上側のチャック１８は試験機に固定される一方、下側のチャック１９は可動部材２０により下向きに５００ｍｍ／分の速度で下降して試験片１６に引張力を作用させる。
【００２６】また、試験片１６を引張する速度を５００ｍｍ／分としたのは、実際の真空加工時に加飾用シート１が引き伸ばされる速度が速すぎて、それを再現測定できる装置が少ないため、一般的な引張試験機で測定可能な範囲のうち最も速いと思われる速度を選定した。これでも加工時に加飾用シート１が伸ばされる速度に比べる

とまだ遅いものの、実際には引張速度の設定を変えても測定データは殆ど変わらないので、これで十分シミュレートできている。なお、この試験は下向きに可動部材２０を下降させて測定したが、下側のチャック１９を試験機に固定する一方、上側のチャック１８を可動部材２０により上向きに５００ｍｍ／分の速度で上昇させて試験片１６に引張力を作用させても同じ結果が得られる。

【００２７】本発明において、加飾用シート１はインサートシートであってもよく、転写シートであってもよい。インサートシートは、基材フィルム上に加飾層などを形成したものであり、射出成形と同時に樹脂成形品１１表面に一体接着化し、そのまま最終形態として使用される。加飾層を基材フィルムの樹脂成形品１１側に設けるか、樹脂成形品１１と反対側に設けるかは任意であるが、普通は加飾層を樹脂成形品１１側に向けて基材フィルムを表面保護膜として利用する。転写シートは、基材フィルムを剥離可能な支持フィルムとし、その上に剥離層、加飾層などの転写層を形成したものであり、必ず転写層を樹脂成形品１１側に向けて金型内に挿入され、射出成形と同時に樹脂成形品１１表面に一体接着化した後、基材フィルムは剥離除去される。

【００２８】上記基材フィルムとしては、ポリエステル系樹脂、ポリプロピレン系樹脂、ポリ塩化ビニル系樹脂、ポリエチレン系樹脂、ポリカーボネート樹脂、ナイロン樹脂、ビニロン樹脂、アセテート樹脂、ポリアミド系樹脂、ポリアクリル系樹脂等、あるいはこれらの各シートの複合体など、通常のインサートシートや転写シートの基材フィルムとして用いられるものを使用することができる。

【００２９】加飾用シート１が転写シートの場合、基材フィルムの剥離性を改善するために、基材フィルム上に離型層を全面的に形成してもよい。離型層は、転写後に基材フィルムを剥離した際に、基材フィルムとともに加飾層などの転写層から離型する層である。離型層の材質としては、メラミン樹脂系離型剤、シリコーン樹脂系離型剤、フッ素樹脂系離型剤、セルロース誘導体系離型剤、尿素樹脂系離型剤、ポリオレフィン樹脂系離型剤、パラフィン系離型剤およびこれらの複合型離型剤などを用いることができる。離型層の形成方法としては、ロールコート法、スプレーコート法などのコート法、グラビア印刷法、スクリーン印刷法などの印刷法がある。また、基材フィルム上に転写層を設ける前に、ヘアライン目の意匠を形成したり、顔料インキで凹凸層を形成し、マット意匠を形成したりして艶消し表面を形成してもよい。ヘアライン目の意匠やマット意匠は部分的に形成してもよい。

【００３０】剥離層は、基材フィルムまたは離型層上に全面的または部分的に形成する。剥離層は、転写後に基材フィルムを剥離した際に、基材フィルムまたは離型層から剥離して被転写物の最外面となる層である。剥離層の材質としては、アクリル系樹脂、ポリエステル系樹脂、ポリ塩化ビニル系樹脂、セルロース系樹脂、ゴム系樹脂、ポリウレタン系樹脂、ポリ酢酸ビニル系樹脂などのほか、塩化ビニル－酢酸ビニル共重合体系樹脂、エチレン－酢酸ビニル共重合体系樹脂などのコポリマーを用いるとよい。剥離層に硬度が必要な場合には、紫外線硬化性樹脂などの光硬化性樹脂、電子線硬化性樹脂などの放射線硬化性樹脂、熱硬化性樹脂などを選定して用いるとよい。剥離層は、着色したものでも、未着色のものでもよい。剥離層の形成方法としては、グラビアコート法、ロールコート法、コンマコート法などのコート法、グラビア印刷法、スクリーン印刷法などの印刷法がある。

【００３１】加飾層は、樹脂成形品１１の表面に文字や図形、記号などを表わしたり、着色表面を表わしたりするためのものである。加飾層は、通常、印刷層として形成する。印刷層の材質としては、ウレタン系樹脂、ビニル系樹脂、ポリアミド系樹脂、ポリエステル系樹脂、アクリル系樹脂、ポリウレタン系樹脂、ポリビニルアセタール系樹脂、ポリエステルウレタン系樹脂、セルロースエステル系樹脂、アルキド樹脂、熱可塑性エラストマーなどの樹脂、好ましくは柔軟な皮膜を作ることができる樹脂をバインダーとし、適切な色の顔料または染料を着色剤として含有する着色インキを用いるとよい。また、前記バインダーにパール顔料を着色剤として含有する光輝性インキを用いてもよい。印刷層の形成方法としては、オフセット印刷法、グラビア印刷法、スクリーン印刷法などの通常の印刷法などを用いるとよい。特に、多色刷りや階調表現を行うには、オフセット印刷法やグラビア印刷法が適している。また、単色の場合には、グラビアコート法、ロールコート法、コンマコート法などのコート法を採用することもできる。印刷層は、表現したい図柄に応じて、全面ベタで設ける場合や部分的に設ける場合がある。

【００３２】また、加飾層は金属薄膜層から構成されるもの、あるいは金属薄膜層と印刷層との組み合わせから構成されるものでもよい。金属薄膜層は加飾層として金属光沢を表現するためのものであり、真空蒸着法、スパッタリング法、イオンプレーティング法、または鍍金法などで形成する。表現したい金属光沢色に応じて、アルミニウム、ニッケル、金、白金、クロム、鉄、銅、スズ、インジウム、銀、チタニウム、鉛、または亜鉛などの金属、またはこれらの合金若しくは化合物を使用する。

【００３３】加飾用シート１を２種以上の積層フィルムにしても良い。たとえば、基材フィルムと加飾層の間に他のフィルムを積層してもよいし、基材フィルムと裏打ちシート（ｂａｃｋｉｎｇ　ｓｈｅｅｔ）、表面保護シート等の他のフィルムとの間に加飾層を形成してもよい。裏打ちシートは、加飾用シート１に腰の強さを付与

して射出成形の型外で予備成形をする場合や射出成形型に挿入する場合の取り扱いを容易にし、成形樹脂９と融着させるためのものである。また、裏打ちシートはそれ自身で加飾機能を持っていてもよい。積層方法としては、一方のフィルム表面が接着性を呈するまで加熱して他方のフィルムを貼り合わせるいわゆる熱ラミネート法や、接着剤を介して２枚のフィルムを貼り合わせるいわゆるドライラミネート法などがある。また、裏打ちシート等の一方のフィルムに加飾層を形成しておき、この加飾層を覆うように基材フィルム材料となる樹脂を押出し成形により被覆するいわゆる押出しコート法などもある。

【００３４】また、成形樹脂９に接着される面の接着性を向上させるためや加飾用シート１を構成する各フィルム間の接着のために、必要に応じて接着層を設けてもよい。接着層は、ポリ塩化ビニル酢酸ビニル共重合体系樹脂、アクリル系樹脂、またはウレタン系樹脂などから構成するとよい。接着層の形成方法としては、グラビアコート法、ロールコート法、コンマコート法などのコート法、グラビア印刷法、スクリーン印刷法などの印刷法がある。

【００３５】また、成形同時加飾成形品の表面強度を向上させためにハードコート層を設けてもよい。ハードコート層としては、熱硬化性のアクリル樹脂やウレタン樹脂、電離放射線硬化性のウレタンアクリレート樹脂、シアノアクリレート樹脂などを使用することができる。ハードコート層の形成方法としては、グラビアコート法、ロールコート法、コンマコート法、ディップコート法などのコート法、スプレー法、グラビア印刷法、スクリーン印刷法などの印刷法がある。

【００３６】また、成形同時加飾成形品が透視部分を有する場合、表面における反射を抑えるために低反射層を設けてもよい。低反射層としては、フッ化マグネシウムなどの低屈折率層単層や低屈折率層と高屈折率層の樹脂層積層により、５５０ｎｍの光線反射率が５％以下になるようにすればよい。低反射層の形成方法としては、蒸着などによる金属膜の形成、コーティングによる樹脂層の積層などがある。

【００３７】加飾用シート１の厚みとしては、５～７００μｍが好ましい。５μｍに満たないと、フィルム強度が低く成形の際にフィルムが破れる問題がある。７００μｍを超えると、巻き状態の加飾用シートとすることが困難であり、生産性が劣るものとなる。

【００３８】次に、成形同時加飾成形品の製造方法を説明する。

【００３９】まず、加飾用シート１を射出成形用金型の可動型３の表面にクランプ部材１４によりセットした後に、可動型３と固定型４との間に挿入した加熱板５等で加飾用シート１を加熱して軟化させ、次いで射出成形用の可動型３の凹部と加飾用シート１との間の空間を密閉して真空吸引孔６から排気して空間内の気圧を下げることによって真空吸引２し、加飾用シート１を引き伸ばして射出成形用の可動型３の凹部すなわちキャビティ形成面７に沿うように立体形状に加工し、成形シート２１を得る（図１および図２参照）。このとき、使用する加飾用シート１が前記した$25<Th\leqq T\leqq(100+Th)$、および$0\leqq(T-Th)^2/(X\times k\times t^3)\leqq 7.1\times10^{-3}$の条件を満たせば、真空成形によって加飾用シート１の意匠に歪みが生じたり、加飾用シート１が焼け焦げたり、また真空成形によっても加飾用シート１が所望の形状に充分に立体加工されなかったりといった問題が生じにくい。立体形状に加工する際、あるいはクランプ部材１４で加飾用シート１を押さえ付けて固定する際に、加飾用シート１の不要部分の打抜き加工をしてもよい。

【００４０】上記方法に代えて、加飾用シート１を射出成形用の可動型３の表面にセットする前に、射出成形用の可動型３と固定型４とは別の立体加工成形用型１２を用い、立体加工成形用型１２の成形面前面に加飾用シート１を間に介して配置した加熱板５等で加飾用シート１を加熱して軟化させ、次いで射出成形用の可動型３の凹部と加飾用シート１との間の空間を密閉して真空吸引孔６から排気して空間内の気圧を下げることによって真空吸引２し、加飾用シート１を引き伸ばして可動型３のキャビティ形成面７に沿うように立体形状に加工して成形シート２１を得た（図６参照）のち、射出成形用の可動型３のキャビティ形成面に、立体加工された加飾用シート１（成形シート２１）をはめ込むようにしてもよい（図７参照）。

【００４１】次に、固定型４に対して可動型３を型閉めして溶融状態の成形樹脂９を固定型４のゲート部８からキャビティ１０内に射出し、成形樹脂９を固化させてキャビティ１０内で樹脂成形品１１を形成すると同時にその表面に加飾用シート１（成形シート２１）を一体化接着させて、成形同時加飾成形品を得る（図３および図４参照）。

【００４２】その後、樹脂成形品１１を可動型３から取り出したのち、樹脂成形品１１に接着した加飾用シート１のうち不要な部分を除去する（図５参照）。なお、前述したようにあらかじめ所望の形状に打ち抜き加工していた場合には、加飾用シート１の不要な部分を除去する作業は不要である。

【００４３】成形樹脂９は、特に限定されることはない。コンソールボックス、センタークラスター、スイッチベースなどの自動車内装部品や携帯電話筐体などの通信機器部品に用いられる代表的な成形樹脂としては、アクリロニトリルブタジエンスチレン共重合樹脂、アクリル樹脂、アクリロニトリルスチレン共重合樹脂、ポリプロピレン樹脂、ポリカーボネート樹脂などが一般的に使用される。

【００４４】なお、横型射出成形機の場合には、上記のとおりであるが、竪型射出成形機の場合には、固定型と可動型の関係が横型射出成形機の場合と逆になる。また、射出成形機の金型は２枚型の場合だけでなく、３枚型の場合にも同様に適用することができる。

【００４５】

【実施例】以下に、より具体的な実施例を挙げる。

＜実施例１＞以下の条件で、建材用の成形同時加飾成形品を製造した。

【００４６】厚み０．０８（ｍｍ）のポリプロピレン系樹脂フィルムを基材フィルムとし、ウレタン系インキを使用しスクリーン印刷法によって加飾層を０．０２（ｍｍ）の厚みに形成し、加飾用シートを得た。この加飾用シートは、ｋ＝１２．８×10^8（Ｐａ）、ｔ＝０．１（ｍｍ）、Ｔｈ＝７０（℃）であった。

【００４７】この加飾用シートを、さまざまな条件にて真空成形加工したところ、以下のような結果が得られた。

【００４８】

【表１】

条件	X	T (℃)	$\frac{(T-Th)^2}{X\times k\times t^3}$ ($\times 10^5$)	評価
1	1．1	65	1．776	×
2	1．1	70	0．000	△
3	1．1	75	1．776	◎
4	1．1	80	7．102	◎
5	1．1	130	255．682	○
6	1．1	150	454．545	○
7	1．1	170	710．227	△
8	1．1	175	783．026	×
9	3．5	65	0．558	×
10	3．5	70	0．000	△
11	3．5	75	0．558	◎
12	3．5	130	80．357	◎
13	3．5	150	142．857	○
14	3．5	170	223．214	△
15	3．5	175	246．094	×
16	6．2	65	0．315	×
17	6．2	70	0．000	△
18	6．2	80	1．260	◎
19	6．2	130	45．363	◎
20	6．2	150	80．645	○
21	6．2	170	126．008	△
22	6．2	175	138．924	×

【００４９】本発明の式（１）および式（２）を満足する条件２～７，１０～１４，１７～２１で真空成形加工された加飾用シートを、射出成形用金型内でゲート部より射出された熔融状態のポリプロピレン樹脂と一体接着化し、建材用の成形同時加飾成形品を得た。

【００５０】＜実施例２＞以下の条件で、自動車内装用の成形同時加飾成形品を製造した。

【００５１】厚み０．２５（ｍｍ）のアクリロニトリルブタジエンスチレン系樹脂フィルムを基材フィルムとし、この上に５種類の木目柄パターンからなる加飾層を塩化ビニル－酢酸ビニル共重合体からなるインキを使用してグラビア印刷法によって０．０１ｍｍ）の厚みに形成し、さらに表面保護シートとして厚み０．２４（ｍｍ）の硬質アクリルフィルムを貼り合せ、加飾用シートを得た。この加飾用シートは、ｋ＝２５．８×10^8（Ｐａ）、ｔ＝０．５（ｍｍ）、Ｔｈ＝７２（℃）であった。

【００５２】この加飾用シートを、表２の条件にて真空成形加工したところ、以下のような結果が得られた。

【００５３】

【表２】

条件	X	T (℃)	$\frac{(T-Th)^2}{X\times k\times t^3}$ ($\times 10^5$)	評価
1	1.1	70	0.001	×
2	1.1	75	0.003	△
3	1.1	80	0.018	○
4	1.1	85	0.048	◎
5	1.1	160	2.183	◎
6	1.1	150	1.715	◎
7	1.1	170	2.707	○
8	1.1	175	2.991	×
9	3.5	70	0.000	×
10	3.5	75	0.001	△
11	3.5	80	0.006	○
12	3.5	130	0.298	◎
13	3.5	150	0.539	◎
14	3.5	170	0.851	○
15	3.5	175	0.940	×
16	6.2	70	0.000	×
17	6.2	75	0.000	△
18	6.2	80	0.003	○
19	6.2	130	0.168	◎
20	6.2	150	0.304	○
21	6.2	170	0.480	△
22	6.2	175	0.531	×

【００５４】本発明の式（１）および式（２）を満足する条件２～７，１０～１４，１７～２１で真空成形加工された加飾用シートを、射出成形用金型内でゲート部より射出された熔融状態の耐熱性アクリロニトリルブタジエンスチレン樹脂と一体接着化し、自動車内装用の成形同時加飾成形品を得た。

【００５５】＜実施例３＞以下の条件で、小型携帯端末ディスプレイ用の成形同時加飾成形品を製造した。

【００５６】厚み０．１３（ｍｍ）のポリカーボネート系樹脂フィルムを基材フィルムとし、この上にメタリック顔料を５％含んだアクリル系樹脂からなるハードコート層をリバースコート法にて全面に０．０７（ｍｍ）の厚みに形成し、その上に、真空蒸着法によりフッ化マグネシウムからなる透明な低反射層を０．０００１（ｍｍ）の厚みに形成し、加飾用シートを得た。この加飾用シートは、ｋ＝２２．７×10^8（Ｐａ）、ｔ＝０．２（ｍｍ）、Ｔｈ＝９３（℃）であった。

【００５７】この加飾用シートを、表３の条件にて真空成形加工したところ、以下のような結果が得られた。

【００５８】

【表３】

条件	X	T (℃)	$\frac{(T-Th)^2}{X\times k\times t^3}$ ($\times 10^5$)	評価
1	1．1	90	0．045	×
2	1．1	95	0．020	△
3	1．1	100	0．245	○
4	1．1	120	3．649	◎
5	1．1	130	6．853	◎
6	1．1	180	37．890	○
7	1．1	190	47．102	△
8	1．1	200	57．314	×
9	3．5	90	0．014	×
10	3．5	95	0．006	△
11	3．5	100	0．077	○
12	3．5	140	3．475	◎
13	3．5	180	11．908	○
14	3．5	190	14．803	△
15	3．5	200	18．013	×
16	6．2	90	0．008	×
17	6．2	95	0．004	△
18	6．2	100	0．044	○
19	6．2	160	3．987	◎
20	6．2	180	6．723	○
21	6．2	190	8．357	△
22	6．2	200	10．169	×

【００５９】本発明の式（１）および式（２）を満足する条件２～７，１０～１４，１７～２１で真空成形加工された加飾用シートを、射出成形用金型内でゲート部より射出された熔融状態のポリカーボネート樹脂と一体接着化し、小型携帯端末ディスプレイ用の成形同時加飾成形品を得た。

【００６０】

【発明の効果】本発明の真空成形加工に適した加飾用シート、これを用いた成形シートの製造方法、成形同時加飾成形品の製造方法および成形同時加飾成形品は、以上のとおりの構成を有するので、次のような優れた効果を有する。

【００６１】すなわち、真空成形加工において、真空成形加工する直前の加飾シートの表面温度をＴ（℃）、加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率が、２５℃で実施したときのヤング率の５０％になったときの加飾用シートの表面温度をＴｈ（℃）、真空成形加工する加飾用シートの厚みをｔ（ｍｍ）、面積伸び比をＸ、Ｔｈ（℃）の環境温度下で、加飾用シートを巾１０ｍｍ、チャック間距離５０ｍｍで引張試験を実施したときのヤング率をｋ（Ｐａ）としたとき、$25<Th\leqq T\leqq(100+Th)$、および$20\leqq(T-Th)^2/(X\times k\times t^3)\leqq 7.1\times 10^{-3}$の条件を満たすので、真空成形によって加飾用シートの意匠に歪みが生じたり、加飾用シートが焼け焦げたり、また真空成形によっても加飾用シートが所望の形状に充分に立体加工されなかったりといった問題が生じにくい。

【図面の簡単な説明】

【図１】加飾用シートの真空成形の工程の一つを示す断面図である。

【図２】加飾用シートの真空成形の工程の一つを示す断面図である。

【図３】成形同時加飾成形品の製造方法の工程の一つを示す断面図である。

【図４】成形同時加飾成形品の製造方法の工程の一つを示す断面図である。

【図５】成形同時加飾成形品の例を示す断面図である。

【図６】加飾用シートの真空成形の工程の一つを示す断面図である。

【図７】成形同時加飾成形品の製造方法の工程の一つを示す断面図である。

【図８】引張試験において使用する引張試験機を示す斜視図である。

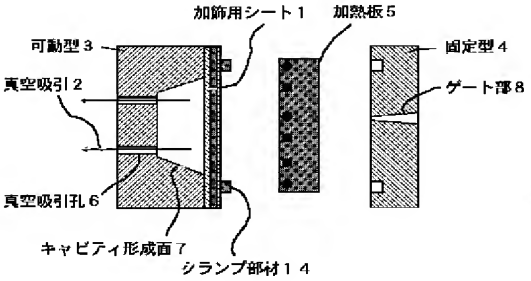
【図９】引張試験において引張試験機の試験片を固定する部分を示す断面図である。

【図１０】加飾用シートの伸び特性を示すグラフである。

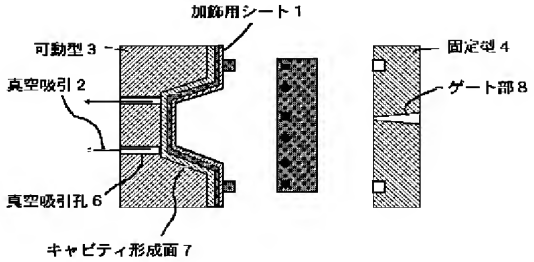
【図１１】真空成形によって加飾用シートに歪みが発生した場合を示す図である。

【図１２】真空成形によっても加飾用シートに歪みが発生しない場合を示す図である。
【図１３】加飾用シートの面積伸び比を説明する図である。
【符号の説明】
１　加飾用シート
２　真空吸引
３　可動型
４　固定型
５　加熱板
６　真空吸引孔
７　キャビティ形成面
８　ゲート部
９　成形樹脂
１０　キャビティ
１１　樹脂成形品
１２　立体加工成形用型
１４　クランプ部材
１５　成形同時加飾成形品
１６　試験片
１７　ネジ
１８　チャック
１９　チャック
２０　可動部材
２１　成形シート

【図１】



【図２】



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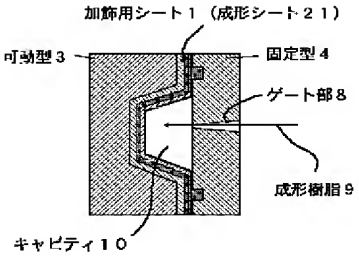

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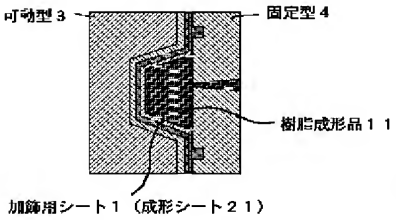

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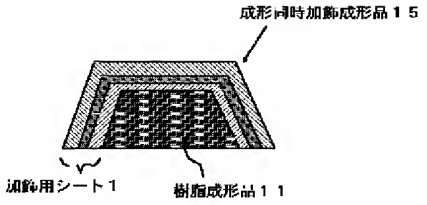

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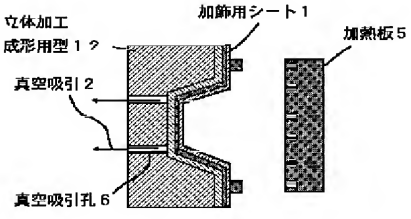

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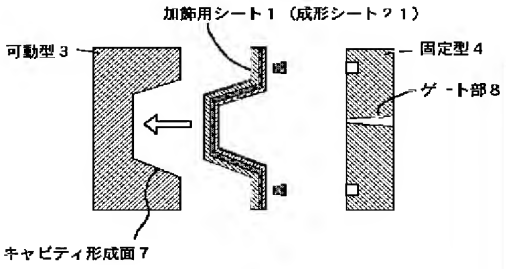

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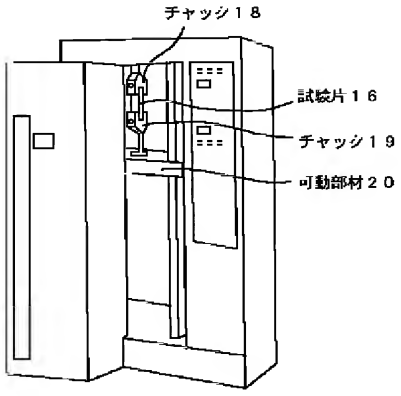
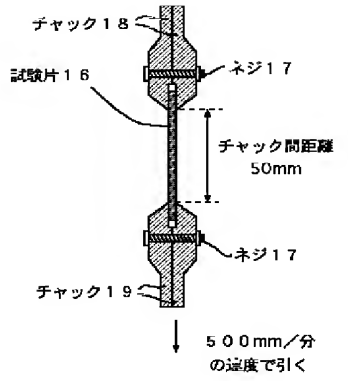


【図９】



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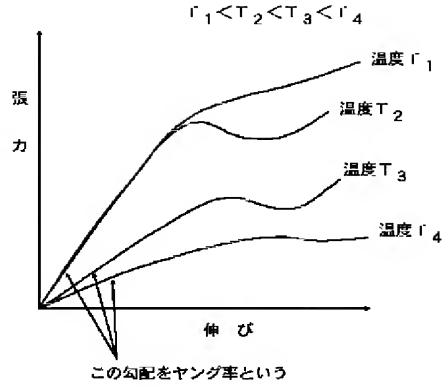
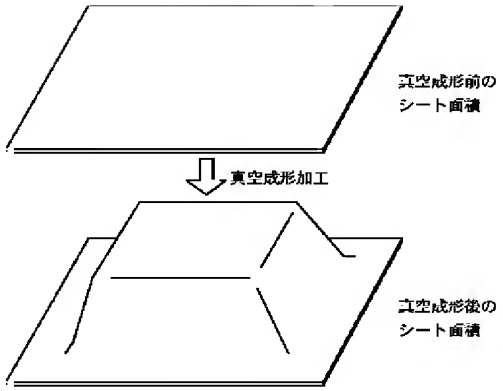
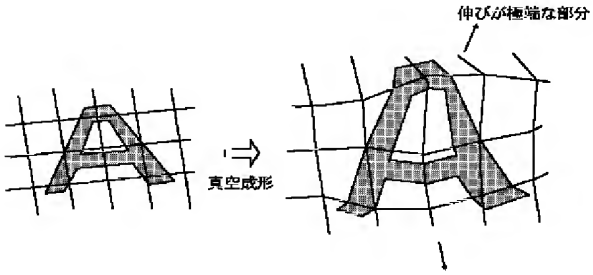


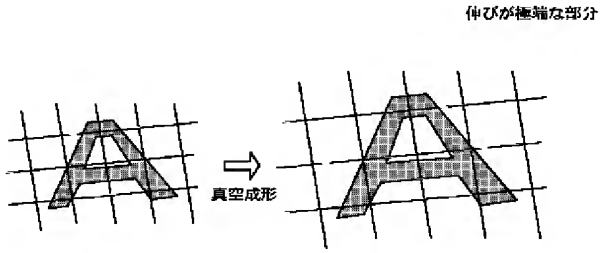
【図１３】



【図１１】



【図１２】



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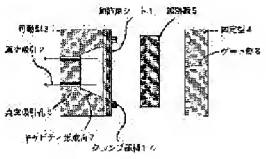
(72)Inventor : MORI FUJIO

(54) DECORATIVE SHEET SUITABLE FOR VACUUM FORMING, METHOD FOR PRODUCING MOLDED SHEET USING THE SHEET, METHOD FOR PRODUCING MOLDING DECORATED SIMULTANEOUSLY WITH MOLDING, AND MOLDING DECORATED SIMULTANEOUSLY WITH MOLDING



(57)Abstract:

PROBLEM TO BE SOLVED: To prevent problems such as the generation of

distortion in the design of a decorative sheet by vacuum forming, the burning of the decorative sheet, and failure in which the decorative sheet is not enough processed three- dimensionally into a desired shape even by the vacuum forming.

SOLUTION: In vacuum forming, when the Young' modulus of the decorative sheet is k (Pa) in a tensile test in which the surface temperature of sheet is Th (° C), the thickness is t (mm), the area expansion ration is X, the width at an ambient temperature of Th (°C) is 10 mm, and the distance between chucks is 50 mm when the Young's modulus in the tensile test in which the surface temperature right before the vacuum forming is T (°C), the width is 10 mm, and the distance between the chucks is 50 mm is 50% of the Young's modulus when the test is implemented at 25°C, the conditions of 25< Th≤T≤(100+Th) and 20≤ (T-Th)2/(X×k×t3)≤7.1×10-3 are satisfied.

LEGAL STATUS

[Date of request for examination]

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[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] The sheet for decoration suitable for vacuum-forming processing which is the sheet for decoration which consists of a base material film and a decoration layer at least, carries out vacuum-forming processing and is used for the configuration of a request behind at shaping coincidence decoration, and is characterized by fulfilling following (1) and the conditions of (2).

25<Th<=T<= (100+Th) -- (1)

0 <=(T-Th) 2/(Xxkxt3) <=7.1x10-3 -- (2)

T (degree C) : The sheet for decoration Skin temperature Th of a decoration sheet just before carrying out vacuum-forming processing (degree C) : [A width of 10mm,] The Young's modulus when carrying out a tension test in the distance between chucks of 50mm thickness X of the sheet for decoration which carries out skin temperature t(mm):vacuum-forming processing of the sheet for decoration when becoming 50% of the Young's modulus when carrying out at 25 degrees C: area elongation ratio k(Pa): -- the sheet for decoration a width of 10mm under the environmental temperature of Th (degree C) Young's modulus when carrying out a tension test in the distance between chucks of 50mm [claim 2] The manufacture approach of the shaping sheet characterized by carrying out vacuum-forming processing at the configuration of the above (1) and a request

on the conditions of (2) of the sheet for decoration of claim 1, and obtaining a shaping sheet.

[Claim 3] The sheet for decoration which consists of a base material film and a decoration layer at least is put in in the metal mold for injection molding. In the manufacture approach of shaping coincidence decoration mold goods of injecting shaping resin to a cavity the mold closure back, making the front face of resin mold goods carrying out unification adhesion of the sheet for decoration, and performing shaping coincidence decoration The manufacture approach of the shaping coincidence decoration mold goods characterized by carrying out vacuum-forming processing at the configuration of the above (1) and a request on the conditions of (2) of the sheet for decoration of claim 1 the inside of the metal mold for injection molding, or out of metal mold before injecting shaping resin to a cavity.

[Claim 4] Shaping coincidence decoration mold goods characterized by carrying out vacuum-forming processing at a desired configuration, and carrying out unification adhesion of the sheet for decoration of claim 1 on the resin mold-goods front face.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The field of the technique in which invention belongs] This invention relates to the manufacture approach of the sheet for decoration used by carrying out vacuum-forming processing, and the shaping sheet using this, the manufacture approach of shaping coincidence decoration mold goods, and shaping coincidence decoration mold goods, in order to carry out the decoration of the front face of solid configuration mold goods.

[0002]

[Description of the Prior Art] Conventionally, there is a shaping coincidence decoration method using the sheet for decoration as an approach of carrying out the decoration of the communication equipment components, such as automobile interior parts, cellular-phone cases, etc., such as a console box, a pin center,large cluster, and the switch base. This approach puts in the sheet 1 for decoration which consists of a base material film and a decoration layer at least in the metal mold for injection molding, injects shaping resin 9 to a cavity 10 the mold closure back, makes the front face of the resin mold goods 11 which solidified shaping resin 9 carry out unification adhesion of the sheet 1 for decoration, and obtains the shaping coincidence decoration mold goods 15 (drawing 3 - 5 reference).

[0003] In the describing [above] shaping coincidence decoration method, before injecting shaping resin 9 to a cavity 10, solid processing is performed beforehand and it usually considers as the shaping sheet 21 so that the cavity forming face 7 of an ejector half 3 may be met in the sheet 1 for decoration within the metal mold for injection molding, and out of metal mold.

[0004] The approach generally widely used as the approach of current and this solid fabrication has vacuum-forming processing. For example, after setting the sheet 1 for decoration to cavity forming face 7 front face of the ejector half 3 for injection molding Heat the sheet 1 for decoration and it is made to soften in the

hot-plate 5 grade inserted between the ejector half 3 and the cover half 4. By performing the so-called vacuum suction 2 which seals the space between the fields which counter the sheet 1 for decoration of a softening condition, and the sheet 1 for decoration of an ejector half 3, and lowers the atmospheric pressure in exhaust air and space from the vacuum suction hole 6 A solid configuration is processed so that the sheet 1 for decoration may be extended and the cavity forming face 7 of an ejector half 3 may be met, and the shaping sheet 21 is obtained (refer to drawing 1 and drawing 2).

[0005] Moreover, as another example of vacuum-forming processing, before setting the sheet 1 for decoration to the ejector half 3 for injection molding Mold 12 for solid processing shaping with another ejector half 3 and cover half 4 for injection molding is used. In the hot plate arranged through the sheet 1 for decoration in between, heat the sheet for decoration to the shaping presence side of the mold 12 for solid processing shaping, and it is softened. The space between the sheet 1 for decoration of a softening condition and the shaping side of the mold 12 for solid processing shaping is sealed. Vacuum suction 2 by carrying out After processing a solid configuration and obtaining the shaping sheet 21 so that the sheet 1 for decoration may be extended and the shaping side of the mold 12 for solid processing shaping may be met (refer to drawing 6), the sheet 1 (shaping sheet 21) for decoration by which solid processing was carried out is inserted in the cavity forming face 7 of the ejector half 3 for injection molding (refer to drawing 7).

[0006]

[Problem(s) to be Solved by the Invention] However, when vacuum-forming processing of the sheet for decoration is carried out with the above mentioned means, it is easy to produce the problem of being as solid processing of the sheet for decoration fully not being carried out by vacuum-forming processing at a desired configuration, either **** [, and]. [that the design of the sheet for decoration is extremely distorted as the conditioning is unsuitable, or the sheet for decoration is torn]

[0007] Therefore, the purpose of this invention is to solve the above-mentioned trouble, and is to offer the manufacture approach of the sheet for decoration suitable for vacuum-forming processing, and the shaping sheet using this, the manufacture approach of shaping coincidence decoration mold goods, and shaping coincidence decoration mold goods.

[0008]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention consists of a base material film and a decoration layer at least. It is the sheet for decoration which carries out vacuum-forming processing and is used for the configuration of a request behind at shaping coincidence decoration. T (degree C) and the sheet for decoration for the skin temperature of a decoration sheet just before carrying out vacuum-forming processing A width of 10mm, The skin temperature of the sheet for decoration when the Young's modulus when carrying out a tension test in the distance between chucks of 50mm turns into 50% of the Young's modulus when carrying out at 25 degrees C Th (degree C), When Young's modulus when carrying [the thickness of the sheet for decoration which carries out vacuum-forming processing / t (mm) and an area elongation ratio] out a tension test for the sheet for decoration in a width of 10mm and the distance between chucks of 50mm under X and the environmental temperature of Th (degree C) is set to k (Pa), It constituted so that 25<Th<=T<= (100+Th) and the conditions of 0 <=(T-Th) 2/(Xxkxt3) <=7.1x10-3 might be fulfilled.

[0009] Moreover, the manufacture approach of the shaping sheet of this invention was constituted so that vacuum-forming processing might be carried out at the configuration of a request of the sheet for decoration suitable for vacuum-forming processing on the conditions of each above-mentioned formula and a shaping sheet might be obtained.

[0010] Moreover, the sheet for decoration which consists of a base material film and a decoration layer at least is put in in the metal mold for injection molding. In the manufacture approach of shaping coincidence decoration mold goods of

injecting shaping resin to a cavity the mold closure back, making the front face of resin mold goods carrying out unification adhesion of the sheet for decoration, and performing shaping coincidence decoration this invention Before injecting shaping resin to a cavity, it constituted in the configuration of a request of the sheet for decoration which fitted said vacuum-forming processing within the metal mold for injection molding, and out of metal mold on the conditions of each above-mentioned formula so that vacuum-forming processing might be carried out.

[0011] Moreover, the shaping coincidence decoration mold goods of this invention were constituted as vacuum-forming processing was carried out at a desired configuration and unification adhesion of the sheet for decoration suitable for said vacuum-forming processing was carried out on the resin mold-goods front face.

[0012]

[Embodiment of the Invention] Hereafter, this invention is explained in more detail, referring to a drawing. The sectional view in which drawing 1 , drawing 2 , and drawing 6 show one of the processes of the vacuum forming of the sheet for decoration, The sectional view in which drawing 3 , drawing 4 , and drawing 7 show one of the processes of the manufacture approach of shaping coincidence decoration mold goods, The sectional view in which drawing 5 shows the example of shaping coincidence decoration mold goods, the perspective view showing the tension tester which uses drawing 8 in a tension test, The sectional view showing the part to which drawing 9 fixes the test piece of a tension tester in a tension test, Drawing showing the case where distortion does not generate drawing and drawing 12 which, as for the graph and drawing 11 drawing 10 indicates the elongation property of the sheet for decoration to be, show the case where distortion occurs on the sheet for decoration with a vacuum forming on the sheet for decoration with a vacuum forming, and drawing 13 are drawings explaining the area elongation ratio of the sheet for decoration. In one, the sheet for decoration and 2 among drawing an ejector half and 4 for vacuum suction and

3 A cover half, In 5, a hot plate and 6 a cavity forming face and 8 for a vacuum suction hole and 7 The gate section, 9 -- shaping resin and 10 -- a cavity and 11 -- resin mold goods and 12 -- the mold for solid processing shaping, and 14 -- a clamp member and 15 -- shaping coincidence decoration mold goods and 16 -- in a chuck and 19, a chuck and 20 show moving-part material and, as for a test piece and 17, 21 shows [a screw and 18] a shaping sheet, respectively.

[0013] In vacuum-forming processing, since all or some of perimeter of a part of the sheet 1 for decoration which carries out vacuum-forming processing is fix by press down the sheet 1 for decoration by clamp member 14 grade on the metal mold front face concerned after arrange the sheet 1 for decoration in the front face of the ejector half 3 for injection molding, or the mold 12 for solid processing shaping, when vacuum suction 2 is take in the condition, a load (tension) will be apply to the sheet 1 for decoration. To the increment in this load, there is proportional part which elongation generates proportionally until it reaches the critical point (elastic limit) of elasticity (Hooke's law), and this critical point is called proportional limit. And when the sheet 1 for decoration follows Hooke's law, the load of the perpendicular direction within the proportional limit and the proportionality constant of elongation are called Young's modulus, but it is dependable to the skin temperature of the sheet 1 for decoration, as shown in drawing 10 . However, proportionality is not necessarily between the skin temperature of the sheet 1 for decoration, and the elongation of the sheet 1 for decoration, and when ordinary temperature to a certain temperature shows the almost same method of elongation (inside T1 and T2 of drawing 10) and exceeds the temperature, it has the inclination to elongation-come to be easy quickly and for Young's modulus to fall (T3 in drawing 10 , T four).

[0014] Since it becomes sufficiently possible by vacuum suction to fabricate only local elongation in a desired configuration the more the more it makes high skin temperature of the sheet 1 for decoration exceeding this temperature when beginning to be extended quickly, an extreme distortion of a pattern deforming or the concentration of (referring to drawing 11) and a color becoming an

ununiformity about the design of the sheet 1 for decoration, becomes easy to take place. Therefore, it is necessary to heat in hot-plate 5 grade so that it may hold down low to the temperature from which distortion cannot produce skin temperature of the sheet 1 for decoration easily (refer to drawing 12) due to vacuum suction.

[0015] the elongation of the sheet 1 for decoration in the temperature which makes high skin temperature of the sheet 1 for decoration exceeding the temperature when beginning to be extended quickly [the above], and shows the method of elongation that the elongation of the sheet 1 for decoration is almost the same when vacuum suction is carried out -- about -- more than twice -- it is . Then, this invention persons first thought that what is necessary was just to set up the skin temperature of the sheet 1 for decoration on the basis of the skin temperature Th (degree C) of the sheet for decoration which becomes 50% of Young's modulus when the Young's modulus when carrying out carries out a tension test in ordinary temperature, i.e., 25 degrees C, in a width of 10mm, and the distance between chucks of 50mm about the sheet for decoration.

[0016] And the result of having checked by trial how much skin temperature [of the decoration sheet in front of processing initiation] T (degree C) having been set up for carrying out it being hard to produce distortion upon a design in vacuum-forming processing, When it becomes as it is shown in Table 1 - 3 and set up highly exceeding 100+Th (degree C) (i.e., if the conditions T<= (100+Th) were not fulfilled), it turned out that the defect by local elongation occurs with most sheets 1 for decoration by which vacuum-forming processing was carried out. In addition, measurement of skin temperature [of a decoration sheet just before carrying out vacuum-forming processing] T (degree C) installs and measures thermography equipment near the sheet 1 for decoration arranged in the front face of metal mold. Moreover, in evaluation of Tables 1-3, O, O, **, x, **, and the following condition are meant, respectively, and these evaluations are based on the result at the time of carrying out by a unit of 10 times under a monograph affair.

O : there is no distortion of a design and fabrication has been carried out to the desired configuration.
O : although distortion or the lack of fabrication of a design exists a little, all are the level no problem is [level] in shaping coincidence decoration.
**: Since distortion or fabrication of a design is insufficient, the defect has occurred in part in shaping coincidence decoration.
x: Since distortion or fabrication of a design is insufficient, the defect has almost occurred in shaping coincidence decoration.
[0017] Moreover, skin temperature [of a decoration sheet just before starting vacuum-forming processing] T (degree C) requires that the decoration sheet 1 should become soft completely, in order for what is necessary to be just not to necessarily simply make it low so that distortion may not arise on the sheet 1 for decoration by vacuum-forming processing and for dimensional accuracy to improve vacuum-forming processing in accordance with a mold configuration. In accordance with a metal mold configuration, dimensional accuracy cannot improve vacuum-forming processing as skin temperature [of a decoration sheet just before carrying out vacuum-forming processing] T (degree C) is under Th (degree C). In addition, since the Young's modulus of the sheet for decoration of Th (degree C) is 50% of the Young's modulus of the sheet for decoration whose skin temperature is 25 degrees C, skin temperature is smaller than the Young's modulus of the 25-degree C sheet for decoration, and as shown in drawing 10 , since the decline in Young's modulus is based on the temperature rise of the sheet for decoration, it is 25<Th.
[0018] From the above thing, it sets to a temperature setup selection of the sheet 1 for decoration to be used, and just before [that] carrying out vacuum-forming processing, and is 25<Th<=T<= (100+Th) at least. -- It is necessary to fulfill the conditions (1).
[0019] However, even if it performs selection of the sheet 1 for decoration to be used, and a temperature setup just before [that] carrying out vacuum-forming processing so that the above-mentioned formula (1) may be realized, the sheet 1

for decoration with which outstanding vacuum-forming processing was performed cannot be obtained.

[0020] For example, when the thermal load to sheet 1 front face for decoration is too large relatively, and it is easy to fabricate it and it became too much to the rigidity of the sheet 1 for decoration at the time of vacuum-forming processing, the sheet 1 for decoration might be lengthened forcibly, an extreme distortion might arise upon the design of the sheet 1 for decoration, and the problem that the sheet 1 for decoration burned and burned depending on the case might arise. On the contrary, when the thermal load to sheet 1 front face for decoration is too small relatively, and it is hard to fabricate it and it became too much to the rigidity of the sheet 1 for decoration at the time of vacuum-forming processing, the problem that solid processing of the sheet 1 for decoration was not fully carried out at a desired configuration might arise. According to the rigidity of the sheet 1 for decoration, the thermal load to sheet 1 front face for decoration must be set up.

[0021] Moreover, according to the area elongation ratio X, the thermal load to sheet 1 front face for decoration must be set up, corresponding to the drawing configuration of shaping coincidence decoration mold goods. Here, the area elongation ratio X is a ratio how much the surface area of the sheet after a vacuum forming becomes to the unit area of the sheet before carrying out vacuum suction (refer to drawing 13).

[0022] That is, in the conditions about a vacuum forming, the rigidity of the drawing configuration of shaping coincidence decoration mold goods or the sheet 1 for decoration is taken into consideration in addition to the above-mentioned formula (1), and it is / (thermal load to sheet 1 front face for decoration) (area elongation ratio x rigidity). It must be fixed proper within the limits with a numeric value. In addition, this rigidity is proportional to the product of Young's modulus [of the sheet 1 for decoration] k (Pa), and the cube of thickness [of the sheet 1 for decoration] t (mm) as a result of this invention persons' trial. Here, although the Young's modulus in the sheet skin temperature at the time of vacuum-forming

processing should have been adopted in fact as Young's modulus k (Pa), since a value became small too much and an error arose, the Young's modulus in Th (degree C) was adopted. Moreover, since it turned out that it becomes easy to carry out a vacuum forming in proportion to 2 when the ease of carrying out of shaping could be evaluated when measuring time amount until it starts vacuum suction and finishes carrying out solid processing completely, T-Th was taken along the axis of abscissa and cycle time was taken along the axis of ordinate (T-Th), we decided to regard this (T-Th) size of 2 as size of the thermal load to sheet 1 front face for decoration.

[0023] Then, as a result of examining according to various conditions, the result of Tables 1-3 was obtained and, thereby, it turned out that the proper range is range shown in the following type (2).

0 <=(T-Th) 2/(Xxkxt3) <=7.1x10-3 -- (2)

[0024] In addition, the Young's modulus in the sheet 1 for decoration of this invention fixes the test piece 16 of the sheet 1 for decoration with a width of face of 10mm in a chuck 18 and the distance between 19 of 50mm using the chucks 18 and 19 of a pair under each environmental temperature, and defines it by the initial modulus of elasticity in tension when carrying out a tension test, having applied the load for the end of a test piece 16 with 500mm constant speed for /. Moreover, environmental temperature is the temperature in the condition that the test piece 16 was heated to the same temperature as the ambient atmosphere of test piece 16 perimeter.

[0025] Size of a test piece 16 is not enlarged for avoiding a test piece becoming soft and becoming full of wrinkles under the above-mentioned environmental temperature, before ****(ing) a test piece 16. Moreover, when size of a test piece 16 is made too much small, it is because a measurement error becomes large. Therefore, as a result of making it as small to extent from which a measurement error does not become a problem as possible, it became the above-mentioned size. In addition, in drawing 8 and drawing 9 , the upper chuck 18 is fixed with a screw 17, where the upper limit of a test piece 16 is inserted. Moreover, the lower

chuck 19 is fixed with a screw 17 in the condition of having faced across the lower limit of a test piece 16. The lower chuck 19 descends downward the rate for 500mm/by the moving-part material 20, and the upper chuck 18 makes tensile force act on a test piece 16, as shown in drawing 8 and drawing 9 , while it is fixed to a testing machine.

[0026] Moreover, since there was little equipment to which the rate by which the sheet 1 for decoration is extended at the time of actual vacuum processing is too quick, and can carry out measurement in the complete different conditiond of it, having considered the rate which **** a test piece 16 as a part for 500mm/selected the rate considered to be the quickest among measurable range with a common tension tester. Since measurement data hardly changes even if it changes a setup of a speed of testing in fact although this is also still late compared with the rate by which the sheet 1 for decoration is lengthened at the time of processing, it can be simulating enough now. In addition, although this trial dropped the moving-part material 20 downward and was measured, while the lower chuck 19 is fixed to a testing machine, the same result is obtained, even if it raises the upper chuck 18 the rate for 500mm/upward by the moving-part material 20 and makes tensile force act on a test piece 16.

[0027] In this invention, the sheet 1 for decoration may be an insertion sheet, and may be an imprint sheet. An insertion sheet forms a decoration layer etc. on a base material film, really adhesion-izes it on resin mold-goods 11 front face to injection molding and coincidence, and is used as the last gestalt as it is. Although it is arbitrary whether a decoration layer is prepared in the resin mold-goods 11 side of a base material film or it prepares in the resin mold goods 11 and the opposite side, a decoration layer is usually turned to the resin mold-goods 11 side, and a base material film is used as a surface protective coat. After an imprint sheet uses a base material film as the support film which can exfoliate, and forms imprint layers, such as stratum disjunctum and a decoration layer, on it, and surely turning an imprint layer to the resin mold-goods 11 side, inserting it into metal mold and really adhesion-izing on resin mold-goods 11 front

face to injection molding and coincidence, exfoliation removal of the base material film is carried out.

[0028] As the above-mentioned base material film, the complex of each [these] sheets, such as polyester system resin, a polypropylene regin, polyvinyl chloride system resin, polyethylene system resin, polycarbonate resin, Nylon, Vinylon resin, acetate resin, polyamide system resin, and Pori acrylic resin, etc. can use what is used as a base material film of the usual insertion sheet or an imprint sheet.

[0029] When the sheet 1 for decoration is an imprint sheet, in order to improve the detachability of a base material film, a mold release layer may be extensively formed on a base material film. When a mold release layer exfoliates a base material film after an imprint, it is a layer released from mold from imprint layers, such as a decoration layer, with a base material film. As the quality of the material of a mold release layer, a melamine resin system release agent, a silicone resin system release agent, a fluororesin system release agent, a cellulosic system release agent, a urea-resin system release agent, a polyolefin resin system release agent, paraffin series release agents, these compound-die release agents, etc. can be used. As the formation approach of a mold release layer, there are print processes, such as the coat methods, such as the roll coat method and a spray coating method, gravure, and screen printing. Moreover, before preparing an imprint layer on a base material film, the design of a hairline eye may be formed, or a concave convex layer may be formed in pigment ink, a mat design may be formed, and a lusterless front face may be formed. The design and mat design of a hairline eye may be formed partially.

[0030] Stratum disjunctum is formed extensively or partially on a base material film or a mold release layer. When stratum disjunctum exfoliates a base material film after an imprint, it is a layer which exfoliates from a base material film or a mold release layer, and serves as the outermost side of a transferred object. It is good to use copolymers, such as vinyl chloride vinyl acetate copolymer system resin besides being acrylic resin, polyester system resin, polyvinyl chloride

system resin, cellulose system resin, rubber system resin, polyurethane system resin, polyvinyl acetate system resin, etc., and ethylene-vinylacetate copolymer system resin, as the quality of the material of stratum disjunctum. It is good to select and use radiation-curing nature resin, such as photo-setting resins, such as ultraviolet-rays hardenability resin, and electron ray hardenability resin, thermosetting resin, etc. for stratum disjunctum, when a degree of hardness is required. The thing whose colored thing is not colored, either is sufficient as stratum disjunctum. As the formation approach of stratum disjunctum, there are print processes, such as the coat methods, such as the gravure coat method, the roll coat method, and a comma coating method, gravure, and screen printing.

[0031] A decoration layer is for expressing an alphabetic character, a graphic form, a notation, etc. with the front face of the resin mold goods 11, or expressing a coloring front face. A decoration layer is usually formed as a printing layer. It is good to use the coloring ink which uses as a binder resin, such as urethane system resin, vinyl system resin, polyamide system resin, polyester system resin, acrylic resin, polyurethane system resin, polyvinyl-acetal system resin, polyester polyurethane system resin, cellulose ester system resin, alkyd resin, and thermoplastic elastomer, and the resin which can make a desirable flexible coat as the quality of the material of a printing layer, and contains the pigment or color of a suitable color as a coloring agent. Moreover, the photoluminescent ink which contains a pearl pigment as a coloring agent may be used for said binder. It is good to use the usual print processes, such as offset printing, gravure, and screen printing, etc. as the formation approach of a printing layer. In order to perform multicolored printing and a gradation expression especially, offset printing and gravure are suitable. Moreover, in the case of monochrome, the coat methods, such as the gravure coat method, the roll coat method, and a comma coating method, are also employable. According to a pattern to express, a printing layer may be partially prepared, when preparing by whole surface solid.

[0032] Moreover, a decoration layer may consist of combination of the thing which consists of metal thin film layers or a metal thin film layer, and a printing

layer. A metal thin film layer is for expressing metallic luster as a decoration layer, and is formed by vacuum evaporation technique, the sputtering method, the ion plating method, or electroplating. According to a metallic luster color to express, metals, such as aluminum, nickel, gold, platinum, chromium, iron, copper, tin, an indium, silver, titanium, lead, or zinc, these alloys, or a compound is used.

[0033] The sheet 1 for decoration may be used as two or more sorts of laminated films. For example, between a base material film and a decoration layer, the laminating of other films may be carried out and a decoration layer may be formed between a base material film and other films, such as a backing sheet (backing sheet) and a surface-protection sheet. A backing sheet is for making easy the handling in the case of inserting in the case where give nerve to the sheet 1 for decoration and preforming is carried out out of the mold of injection molding, or an injection-molding mold, and carrying out welding to shaping resin 9. Moreover, the backing sheet may have a decoration function by itself. There are so-called heat laminating method which heats as the laminating approach until one film front face presents an adhesive property, and sticks the film of another side, the so-called dry laminate method which sticks the film of two sheets through adhesives. Moreover, the decoration layer is formed in one film, such as a backing sheet, and there is the so-called extrusion coat method which covers with extrusion molding the resin which serves as a base material film material so that this decoration layer may be covered.

[0034] Moreover, in order to raise the adhesive property of the field pasted up on shaping resin 9, a glue line may be prepared if needed for adhesion between each film which constitutes the sheet 1 for decoration. A glue line is good to constitute from polyvinyl chloride acetate copolymer system resin, acrylic resin, or urethane system resin. As the formation approach of a glue line, there are print processes, such as the coat methods, such as the gravure coat method, the roll coat method, and a comma coating method, gravure, and screen printing.

[0035] Moreover, a rebound ace court layer may be prepared for the surface reinforcement of shaping coincidence decoration mold goods to want to improve.

As a rebound ace court layer, thermosetting acrylic resin and urethane resin, the urethane acrylate resin of ionizing-radiation hardenability, cyanoacrylate resin, etc. can be used. As the formation approach of a rebound ace court layer, there are print processes, such as the coat methods, such as the gravure coat method, the roll coat method, a comma coating method, and a dip coating method, a spray method, gravure, and screen printing.

[0036] Moreover, when shaping coincidence decoration mold goods have a fluoroscopy part, in order to suppress the reflection in a front face, a low reflecting layer may be prepared. What is necessary is just to make it the beam-of-light reflection factor of 550nm become 5% or less as a low reflecting layer by the resin layer laminating of low refractive-index layer monolayers, such as magnesium fluoride, a low refractive-index layer, and a high refractive-index layer. As the formation approach of a low reflecting layer, there are formation of the metal membrane by vacuum evaporationo etc., a laminating of the resin layer by coating, etc.

[0037] As thickness of the sheet 1 for decoration, 5-700 micrometers is desirable. If 5 micrometers is not fulfilled, in case film reinforcement is shaping low, there is a problem by which a film is beaten. When it exceeds 700 micrometers, it is difficult to consider as the sheet for decoration of a volume condition, and productivity is inferior.

[0038] Next, the manufacture approach of shaping coincidence decoration mold goods is explained.

[0039] First, after setting the sheet 1 for decoration to the front face of the ejector half 3 of a injection molding die by the clamp member 14 Heat the sheet 1 for decoration and it is made to soften in the hot-plate 5 grade inserted between the ejector half 3 and the cover half 4. Subsequently, it takes vacuum suction 2 by sealing the space between the crevice of the ejector half 3 for injection molding, and the sheet 1 for decoration, exhausting from the vacuum suction hole 6, and lowering the atmospheric pressure in space. A solid configuration is processed so that the sheet 1 for decoration may be extended and it may meet, the crevice

7, i.e., the cavity forming face, of an ejector half 3 for injection molding, and the shaping sheet 21 is obtained (refer to drawing 1 and drawing 2). If 25<Th<=T<= (100+Th) which the sheet 1 for decoration to be used described above at this time, and the conditions of 0 <=(T-Th) 2/(Xxkxt3) <=7.1x10-3 are fulfilled It is hard to produce the problem of being as solid processing of the sheet 1 for decoration fully not being carried out by the vacuum forming at a desired configuration **** [, and]. [distortion arising upon the design of the sheet 1 for decoration with a vacuum forming, or the sheet 1 for decoration being burned, and burning] In case a solid configuration is processed, or in case the sheet 1 for decoration is pressed down and it fixes by the clamp member 14, blanking processing of the garbage of the sheet 1 for decoration may be carried out.

[0040] Before replacing with the above-mentioned approach and setting the sheet 1 for decoration to the front face of the ejector half 3 for injection molding Mold 12 for solid processing shaping with another ejector half 3 and cover half 4 for injection molding is used. In the hot-plate 5 grade arranged through the sheet 1 for decoration in between, heat the sheet 1 for decoration to the shaping presence side of the mold 12 for solid processing shaping, and it is softened. Subsequently, it takes vacuum suction 2 by sealing the space between the crevice of the ejector half 3 for injection molding, and the sheet 1 for decoration, exhausting from the vacuum suction hole 6, and lowering the atmospheric pressure in space. After processing a solid configuration and obtaining the shaping sheet 21 so that the sheet 1 for decoration may be extended and the cavity forming face 7 of an ejector half 3 may be met (refer to drawing 6), You may make it insert in the cavity forming face of the ejector half 3 for injection molding the sheet 1 (shaping sheet 21) for decoration by which solid processing was carried out (refer to drawing 7).

[0041] Next, inject the shaping resin 9 of a melting condition in a cavity 10 from the gate section 8 of a cover half 4, the front face is made to mold closure carry out of the ejector half 3 to a cover half 4, and to carry out unification adhesion of the sheet 1 (shaping sheet 21) for decoration at the same time it solidifies

shaping resin 9 and forms the resin mold goods 11 within a cavity 10, and shaping coincidence decoration mold goods are obtained (refer to drawing 3 and drawing 4).

[0042] Then, after taking out the resin mold goods 11 from an ejector half 3, an unnecessary part is removed among the sheets 1 for decoration adhered to the resin mold goods 11 (refer to drawing 5). In addition, as mentioned above, when it pierces in a desired configuration and it is processed beforehand, the activity which removes the unnecessary part of the sheet 1 for decoration is unnecessary.

[0043] Especially shaping resin 9 is not limited. Generally as typical shaping resin used for communication equipment components, such as automobile interior parts, cellular-phone cases, etc., such as a console box, a pin center,large cluster, and the switch base, acrylonitrile butadiene styrene copolymer, acrylic resin, acrylonitrile styrene copolymerization resin, polypropylene resin, polycarbonate resin, etc. are used.

[0044] In addition, in the case of a horizontal-type injection molding machine, although it is as above-mentioned, in the case of a vertical-type injection molding machine, it becomes to the case where the relation between a cover half and an ejector half is a horizontal-type injection molding machine, and reverse. Moreover, the metal mold of an injection molding machine is applicable similarly [not only the case of a two sheet mold but in the case of a three sheet mold].

[0045]

[Example] A more concrete example is given to below.

On condition that below <an example 1>, the shaping coincidence decoration mold goods for building materials were manufactured.

[0046] The polypropylene regin film of thickness 0.08 (mm) was used as the base material film, using urethane system ink, with screen printing, the decoration layer was formed in the thickness of 0.02 (mm), and the sheet for decoration was obtained. This sheet for decoration was k=12.8x108(Pa) t=0.1(mm) Th=70(degree-C).

[0047] The following results were obtained when vacuum-forming processing of

this sheet for decoration was carried out on various conditions.

[0048]

[Table 1]

条件	X	T (℃)	$\frac{(T-Th)^2}{X \times k \times t^3}$ ($\times 10^5$)	評価
1	1．1	65	1．776	×
2	1．1	70	0．000	△
3	1．1	75	1．776	◎
4	1．1	80	7．102	◎
5	1．1	130	255．682	○
6	1．1	150	454．545	○
7	1．1	170	710．227	△
8	1．1	175	783．026	×
9	3．5	65	0．558	×
10	3．5	70	0．000	△
11	3．5	75	0．558	◎
12	3．5	130	80．357	◎
13	3．5	150	142．857	○
14	3．5	170	223．214	△
15	3．5	175	246．094	×
16	6．2	65	0．315	×
17	6．2	70	0．000	△
18	6．2	80	1．260	◎
19	6．2	130	45．363	◎
20	6．2	150	80．645	○
21	6．2	170	126．008	△
22	6．2	175	138．924	×

[0049] The conditions 2-7 with which are satisfied of the formula (1) and formula (2) of this invention, 10-14, and the sheet for decoration by which vacuum-forming processing was carried out by 17-21 were the polypropylene resin of a melting condition injected from the gate section within the injection molding die, and really adhesion-ized, and the shaping coincidence decoration mold goods for building materials were obtained.

[0050] On condition that below <an example 2>, the shaping coincidence decoration mold goods of automatic wearing in the car were manufactured.

[0051] The acrylonitrile styrene-butadiene-rubber system resin film of thickness

0.25 (mm) was used as the base material film, the decoration layer which consists of five kinds of grain shank patterns on this was formed in the thickness of 0.01mm with gravure using the ink which consists of a vinyl chloride vinyl acetate copolymer, and lamination and the sheet for decoration were further obtained for the hard acrylic film of thickness 0.24 (mm) as a surface-protection sheet. This sheet for decoration was k=25.8x108(Pa) t=0.5(mm) Th=72(degree-C).

[0052] The following results were obtained when vacuum-forming processing of this sheet for decoration was carried out on condition that Table 2.

[0053]

[Table 2]

条件	X	T (℃)	$\frac{(T-Th)^2}{X \times k \times t^3}$ ($\times 10^5$)	評価
1	1．1	70	0．001	×
2	1．1	75	0．003	△
3	1．1	80	0．018	○
4	1．1	85	0．048	◎
5	1．1	160	2．183	◎
6	1．1	150	1．715	◎
7	1．1	170	2．707	○
8	1．1	175	2．991	×
9	3．5	70	0．000	×
10	3．5	75	0．001	△
11	3．5	80	0．006	○
12	3．5	130	0．298	◎
13	3．5	150	0．539	◎
14	3．5	170	0．851	○
15	3．5	175	0．940	×
16	6．2	70	0．000	×
17	6．2	75	0．000	△
18	6．2	80	0．003	○
19	6．2	130	0．168	◎
20	6．2	150	0．304	○
21	6．2	170	0．480	△
22	6．2	175	0．531	×

[0054] The conditions 2-7 with which are satisfied of the formula (1) and formula

(2) of this invention, 10-14, and the sheet for decoration by which vacuum-forming processing was carried out by 17-21 were the heat-resistant acrylonitrile butadiene styrene resin of a melting condition injected from the gate section within the injection molding die, and really adhesion-ized, and the shaping coincidence decoration mold goods of automatic wearing in the car were obtained.

[0055] On condition that below <an example 3>, the shaping coincidence decoration mold goods for a small personal digital assistant display were manufactured.

[0056] The polycarbonate system resin film of thickness 0.13 (mm) was used as the base material film, the rebound ace court layer which consists of acrylic resin which contained metallic pigment 5% on this was formed in the whole surface by the reverse coat method at the thickness of 0.07 (mm), the transparent low reflecting layer which consists of magnesium fluoride with a vacuum deposition method was formed on it at the thickness of 0.0001 (mm), and the sheet for decoration was obtained. This sheet for decoration was k=22.7x108(Pa) t=0.2(mm) Th=93(degree-C).

[0057] The following results were obtained when vacuum-forming processing of this sheet for decoration was carried out on condition that Table 3.

[0058]

[Table 3]

条件	X	T (℃)	$\frac{(T-Th)^2}{X \times k \times t^3}$ ($\times 10^5$)	評価
1	1．1	90	0．045	×
2	1．1	95	0．020	△
3	1．1	100	0．245	○
4	1．1	120	3．649	◎
5	1．1	130	6．853	◎
6	1．1	180	37．890	○
7	1．1	190	47．102	△
8	1．1	200	57．314	×
9	3．5	90	0．014	×
10	3．5	95	0．006	△
11	3．5	100	0．077	○
12	3．5	140	3．475	◎
13	3．5	180	11．908	○
14	3．5	190	14．803	△
15	3．5	200	18．013	×
16	6．2	90	0．008	×
17	6．2	95	0．004	△
18	6．2	100	0．044	○
19	6．2	160	3．987	◎
20	6．2	180	6．723	○
21	6．2	190	8．357	△
22	6．2	200	10．169	×

[0059] The conditions 2-7 with which are satisfied of the formula (1) and formula (2) of this invention, 10-14, and the sheet for decoration by which vacuum-forming processing was carried out by 17-21 were the polycarbonate resin of a melting condition injected from the gate section within the injection molding die, and really adhesion-ized, and the shaping coincidence decoration mold goods for a small personal digital assistant display were obtained.

[0060]

[Effect of the Invention] Since the manufacture approach of the sheet for decoration suitable for vacuum-forming processing of this invention and the shaping sheet using this, the manufacture approach of shaping coincidence decoration mold goods, and shaping coincidence decoration mold goods have a configuration as above, they have the following outstanding effectiveness.

[0061] In vacuum-forming processing, the skin temperature of a decoration sheet just before carrying out vacuum-forming processing Namely, T (degree C), The Young's modulus when carrying out a tension test in a width of 10mm and the distance between chucks of 50mm the sheet for decoration t (mm) and an area elongation ratio for the thickness of Th (degree C) and the sheet for decoration which carries out vacuum-forming processing under X and the environmental temperature of Th (degree C) [the skin temperature of the sheet for decoration when becoming 50% of the Young's modulus when carrying out at 25 degrees C] When Young's modulus when carrying out a tension test for the sheet for decoration in a width of 10mm and the distance between chucks of 50mm is set to k (Pa), Since 25<Th<=T<= (100+Th) and the conditions of 20 <=(T-Th) 2/(Xxkxt3) <=7.1x10-3 are fulfilled It is hard to produce the problem of being as solid processing of the sheet for decoration fully not being carried out by the vacuum forming at a desired configuration **** [, and]. [distortion arising upon the design of the sheet for decoration with a vacuum forming, or the sheet for decoration being burned, and burning]

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing one of the processes of the vacuum forming of the sheet for decoration.

[Drawing 2] It is the sectional view showing one of the processes of the vacuum forming of the sheet for decoration.

[Drawing 3] It is the sectional view showing one of the processes of the manufacture approach of shaping coincidence decoration mold goods.

[Drawing 4] It is the sectional view showing one of the processes of the manufacture approach of shaping coincidence decoration mold goods.

[Drawing 5] It is the sectional view showing the example of shaping coincidence decoration mold goods.

[Drawing 6] It is the sectional view showing one of the processes of the vacuum forming of the sheet for decoration.

[Drawing 7] It is the sectional view showing one of the processes of the manufacture approach of shaping coincidence decoration mold goods.

[Drawing 8] It is the perspective view showing the tension tester used in a tension test.

[Drawing 9] It is the sectional view showing the part which fixes the test piece of a tension tester in a tension test.

[Drawing 10] It is the graph which shows the elongation property of the sheet for decoration.

[Drawing 11] It is drawing showing the case where distortion occurs on the sheet for decoration with a vacuum forming.

[Drawing 12] It is drawing showing the case where distortion does not occur on the sheet for decoration also with a vacuum forming.

[Drawing 13] It is drawing explaining the area elongation ratio of the sheet for decoration.

[Description of Notations]

1 Sheet for Decoration

2 Vacuum Suction

3 Ejector Half

4 Cover Half

5 Hot Plate

6 Vacuum Suction Hole

7 Cavity Forming Face

8 Gate Section

9 Shaping Resin

10 Cavity

11 Resin Mold Goods

12 Mold for Solid Processing Shaping

14 Clamp Member

15 Shaping Coincidence Decoration Mold Goods

16 Test Piece

17 Screw

18 Chuck

19 Chuck

20 Moving-Part Material

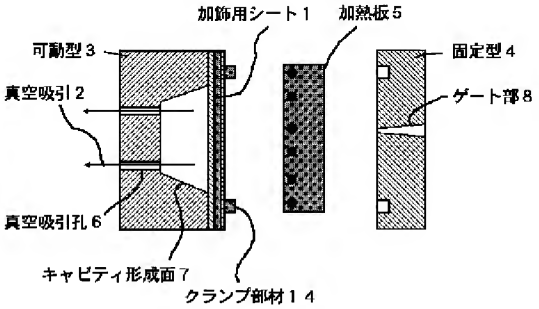
21 Shaping Sheet

[Translation done.]

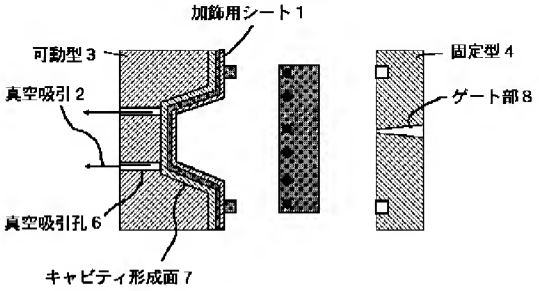
* NOTICES *

DRAWINGS

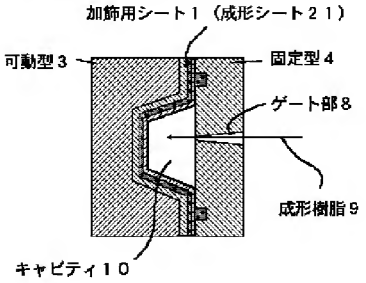
[Drawing 1]



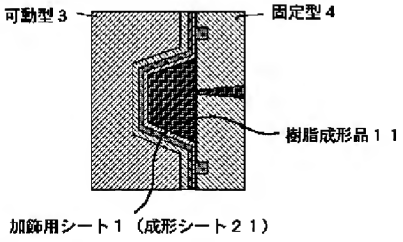
[Drawing 2]



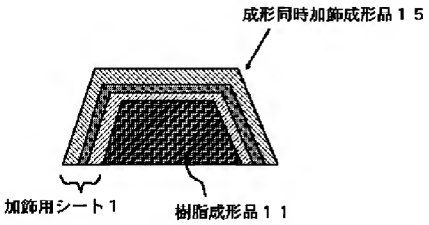
[Drawing 3]



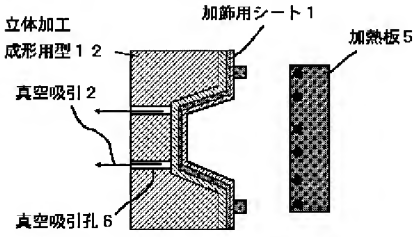
[Drawing 4]



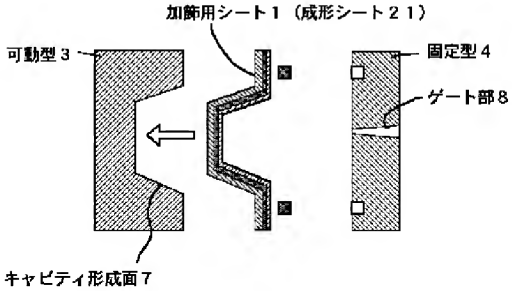
[Drawing 5]



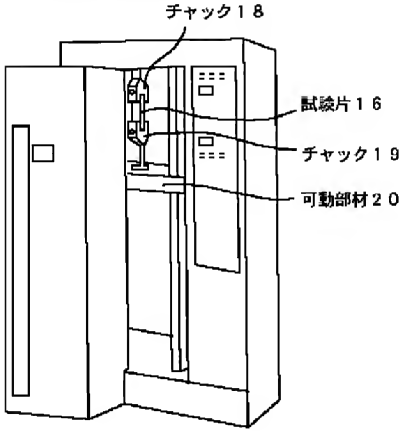
[Drawing 6]



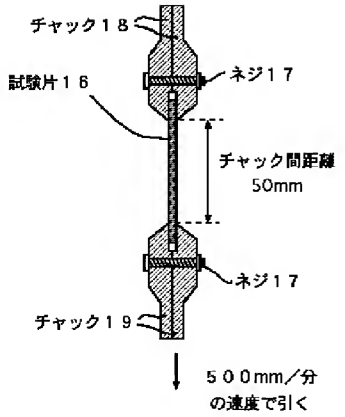
[Drawing 7]



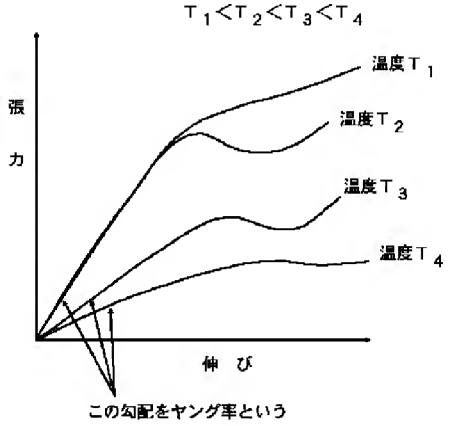
[Drawing 8]



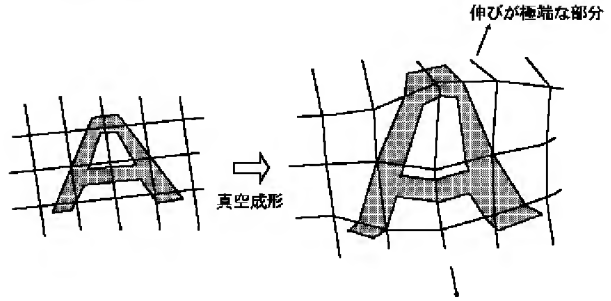
[Drawing 9]



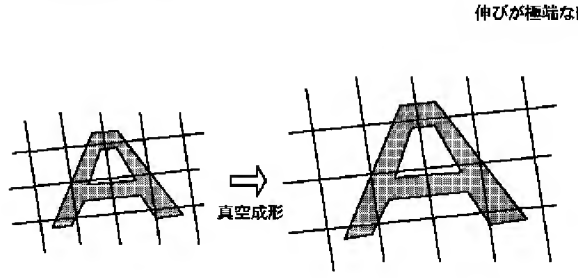
[Drawing 10]



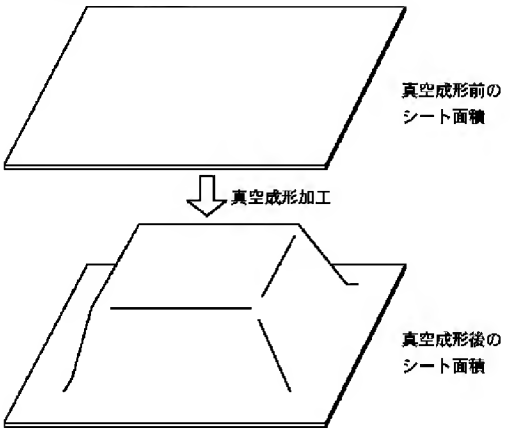
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Translation done.]